TONTO NATIONAL FOREST
RIPARIAN AMPHIBIANS AND REPTILES SURVEY: LOCALITY INFORMATION AND SURVEY RESULTS FOR 1992 AND 1993 FIELD SEASONS

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INTRODUCTION

We surveyed selected sites in Tonto National Forest (TNF) for five riparian amphibian and reptile species in 1992 and 1993 through a Cost-share Agreement CCS 12-03-91-015P between TNF and the Arizona Game and Fish Department (AGFD). These surveys expanded the scope of leopard frog surveys conducted in 1991 (Sredl and Howland 1992a). In both years, leopard frog species of interest were the Chiricahua leopard frog (*Rana chiricahuensis*) and lowland leopard frog (*R. yavapaiensis*). In addition to leopard frogs, the Arizona toad (*Bufo m. microscaphus*), and two species of garter snake, the narrow-headed garter snake (*Thamnophis rufipunctatus*) and the Mexican garter snake (*T. eques*) were targeted. All target species are listed as forest sensitive (U.S. Forest Service 1988), state candidate for listing or threatened (Arizona Game and Fish Department 1988), or federal category 2 (U.S. Fish and Wildlife Service 1991)(Table 1).

Leopard Frogs: Habitats where leopard frogs have been recorded in TNF include: lakes, springs, stock tanks, streams, and rivers. The Chiricahua leopard frog is known from the Payson and Pleasant Valley ranger districts (Arizona Game and Fish Department 1994). Cave Creek, Globe, Mesa, Pleasant Valley, and Tonto Basin ranger districts were historically inhabited by lowland leopard frogs (Arizona Game and Fish Department 1994). While no specimens of northern leopard frog are known from TNF, a *R. pipiens*-like specimen was collected at Fossil Springs in the Payson Ranger District (M.J. Sredl unpubl. data).

Localities reported here are limited to those surveyed under the 1992-1993 cost-share agreement. Platz and Platz (1973), Platz (1976), Platz and Mecham (1979), Frost and Platz (1983), Platz and Frost (1984), Scott and Jennings (1985), and Clarkson and Rorabaugh (1989) provide supplementary information on leopard frogs and report additional TNF localities. For more historical sites and updates, refer to the Heritage Data Management System (HDMS, Habitat Branch, AGFD) or contact the Nongame Branch, Amphibians and Reptiles Program, AGFD.

Depending on elevation and weather, leopard frogs may be active and encountered from late February through November. Lowland leopard frogs, found below 1692 meters (5500 feet) elevation, have a much longer active period than Chiricahua leopard frogs and northern leopard frogs, which occur at higher elevations. There is significant overlap in elevational ranges and habitat requirements of lowland and Chiricahua leopard frogs and Chiricahua and northern leopard frogs. These species pairs have been known to occur in sympatry (Platz 1976, Platz and Frost 1984). Elevational ranges and other relevant ecological data may be found in Appendix

A (**Characteristics of Arizona's Leopard Frogs**) or Stebbins (1985). For assistance in identifying the leopard frogs of TNF, refer to Appendix B (**True Frogs of Tonto National Forest**) or Stebbins (1985).

Arizona Toads: In TNF, Arizona toads have been reported from the Globe, Payson, and Pleasant Valley ranger districts. While we know of no records from the Cave Creek Ranger District, they almost certainly occur there. These toads prefer to breed in gently flowing water, usually with well-developed riparian vegetation. They are often found in the same habitats as leopard frogs. Arizona toads breed from late February to June (Sullivan 1994), depending on weather and elevation. It is easiest to survey adult Arizona toads while they are breeding, by listening for calling males and censusing breeding adults. Calling and mating commonly begin at sunset and last for two to four hours. Arizona toad tadpoles begin metamorphosing in early May and continue through August. Metamorph Arizona toads are identified by their yellow feet, oval parotoid glands, and light bar across the eyelids. For characteristics of adults and further description of Arizona toad habitat see Sullivan (1994) or Stebbins (1985). For additional information on historical localities, see Sullivan (1994). For additional localities or updates refer to HDMS (Habitat Branch, AGFD) or contact the Nongame Branch, Amphibians and Reptiles Program, AGFD.

Garter Snakes: Rosen and Schwalbe (1988) examined the statewide distribution of narrow-headed and Mexican garter snakes. Both species are closely tied to riparian habitats. In TNF, Mexican garter snakes are known from large creeks and rivers in the Cave Creek and Tonto Basin ranger districts. While there are no historical records, it is possible that this species could be found in the Mesa Ranger District, because it has been collected near the city of Mesa (Rosen and Schwalbe 1988). Mexican garter snakes are highly aquatic, and are confined to lotic systems.

The narrow-headed garter snake is known from TNF localities in the Globe and Payson ranger districts (Rosen and Schwalbe 1988). The narrow-headed garter snake is even more aquatic than the Mexican garter snake, leaving the water only to bask (especially gestating females) or to seek cover (Rosen and Schwalbe 1988).

Rosen and Schwalbe (1988) searched museum collections for records of both garter snake species, and include a comprehensive list of historical localities for them; some of these localities are in TNF. For additional TNF localities or updates, refer to HDMS (Habitat Branch, AGFD) or contact the Nongame Branch, Amphibians and Reptiles Program, AGFD. For assistance in identification of narrow-headed, checkered, and Mexican garter snakes, and how to differentiate these species from the more common wandering and black-necked garter snakes, see Rosen and Schwalbe (1988) and Appendix C (Garter Snakes of Tonto National Forest).

METHODS

We surveyed for riparian amphibians and reptiles by walking steadily along, around, or in aquatic habitats while looking and listening for herpetofauna activity. To maximize the chance of encounter during surveys, we constantly scanned the shoreline, embankments, or other appropriate areas from one to ten meters from our position while we walked. We carried a long-handled dip net to aid in capture of animals, and used the handle of the net to comb and probe dense bushes and grasses. We also looked under rocks, logs, and other debris for amphibians and reptiles. Whenever possible, animals were captured, photographed, and released or retained as voucher specimens (if population was sufficiently large or appearance of specimen ambiguous) and positively identified to species. If animals were not captured or positively identified to species, we assigned an "uncertain" code to that observation.

Frequently observed activities included basking, escape, and foraging. Frogs and snakes often thermoregulate by basking on rocks, bushes, logs, and other features near shore. Occasionally, we found garter snakes foraging for tadpoles or fish in pools. The most commonly observed behavior for all reptiles and amphibians was escape behavior. Frogs were often observed leaping to shoreline cover or escaping underwater. Providing the water was shallow and clear, frogs that leapt into water could often be hand-captured or netted and identified to species. From a distance, garter snakes could be seen swimming downstream or to cover on shore or at the bottom. Whenever possible, garter snakes also were captured and identified to species. Surveys for adult Arizona toads are best done at night from March to July when adults are easily heard (calling males) and seen (adult males, females and, at the right time of year, metamorphs). Daytime searches for adults are usually ineffective, and are not recommended; however, tadpoles and strings of eggs may be seen. Metamorph Arizona toads can be found during daylight from late May until August, depending on weather and elevation.

Most surveys were conducted during the daytime, between dawn and dusk, from June through September. The length of habitat searched depended on the size of the system surveyed. Shores of stock tanks, small lakes, and springs were searched in their entirety by walking in and out of the water whenever possible. The shoreline and banks of larger lakes, streams, and rivers were partially searched. For lakes or wetlands that were approximately 8.0 hectares (20 acres) or larger, only a portion of the perimeter was surveyed. Streams and rivers were surveyed by walking a segment of at least 400 meters (one-quarter mile). Inaccessibility or absence of habitat caused some surveys to be curtailed at lesser distances.

Numbers of individuals of target species encountered were recorded as exact numbers when possible. It was often impossible, however, to make an exact count, particularly with larvae and large populations of adults. For non-target amphibians and reptiles, presence/absence was recorded. If more than one trip was made around the perimeter of an enclosed body of water (most stock tanks and lakes), encounters with herpetofauna were recorded only during the first walk around the perimeter, unless numbers and individuals encountered were clearly different

on the second pass. For linear aquatic systems (small lotic and narrow lentic systems), numbers of herps encountered were recorded while walking one direction only, unless individuals observed were unambiguously different.

Upon completion of a survey, we filled out a **Riparian Herp Survey Form** (Appendix D) for each site. The front and back of these data forms are divided into three sections. The top section on the front of the form is for site-specific locality data, the bottom section is for data relating to herpetofauna observations, and the back of the data sheet pertains to habitat conditions. Depending on site history and survey outcome, as outlined below, we completed the back of the form (conditions data). This section includes atmospheric and aquatic conditions, measures of habitat quality, relative abundance of important predators of target species, and comments on incidence of disease and other impacts which may negatively affect target species. We completed this section for historical localities, regardless of the survey outcome, and for non-historical localities where target species were found. For non-historical localities where target species were not found, we completed only the top (locality data) and bottom (herpetofauna observations) sections. For further explanation of survey form data fields refer to **1993 Riparian Herp Survey Form Instructions** (Appendix D). Data from 1992 and 1993 surveys have been entered into a dBASE IV® database (Arizona Game and Fish Department 1994). Tables 2 and 3 and Appendices E, F, G, and H are partial outputs of this database. Output from this database will be forwarded for inclusion in the HDMS. Completed survey forms and photocopies of topographic maps with survey areas delineated are available upon request from the Nongame Branch, Amphibians and Reptiles Program, AGFD.

Because of the large temporal differences in activity of target organisms, determining their presence or absence from historical or potential localities is difficult. Presence or absence at a locality can only be concluded with multiple visits during times of peak activity over a long interval of time. Corn and Fogleman (1984) suggest if frogs and reproduction are not observed over a three-year period, the population has been extirpated. This three year period probably works well for all Arizona leopard frogs, except the Ramsey Canyon leopard frog (J.E. Platz pers. comm.).

RESULTS

1992: During 1992, we surveyed 106 sites in TNF, five of which had historical records for target species (Table 2a, Appendix E, Map 1). Lowland leopard frogs were found at 29 localities (11, 15, 23, 53, 64, 80, 83, 85, 87, 88, 92, 97, 114, 115, 118, 119, 121, 123, 125, 129, 130, 140, 141, 142, 154, 155, 171, 173, 175). Unfortunately, no historical lowland leopard frog records exist for these localities. Some sites, however, were located in the vicinity of historical localities (23, 80), while surveys at other sites verified earlier reports (AGFD unpubl. data) of populations suspected to be lowland leopard frogs (15, 23, 53, 64, 92, 114, 142, 154). We

found Chiricahua leopard frogs at one locality (204); no historical data exist for this site. We surveyed one historical Chiricahua leopard frog locality (110) where we found no frogs.

We found no Arizona toads or Mexican garter snakes during our 1992 surveys. A single narrow-headed garter snake was found during surveys of the East Verde River (98), a historical locality (Table 2b, Appendix E). A survey of one other historical narrow-headed garter snake locality (104) failed to find individuals of that species.

We surveyed sites in six ranger districts (Table 2c). The largest numbers of surveys were conducted in Globe and Tonto Basin ranger districts (n=31 in each district), and the fewest in Cave Creek Ranger District (n=10). For a complete list of all reptiles and amphibians encountered during 1992 surveys, see Appendix E. For Universal Transverse Mercator (UTM) coordinates of historical sites for target species and sites at which we found target species, refer to Appendix F.

1993: In 1993, we surveyed 68 sites in TNF, five of which had historical records for target species (Table 3a, Appendix G, Map 1). Some sites visited in 1992 were re-visited in 1993. We found lowland leopard frogs at nine localities (19, 23, 24, 63, 87, 88, 178, 196, 218). Unfortunately, little historical information exists for these sites. We verified the presence of Chiricahua leopard frogs at Frog Pond (204), and found two new populations of this species (187, 188); no historical data exist for these sites. We surveyed two historical Chiricahua leopard frog localities (110, 215), but found no frogs.

We found Arizona toads at two sites (121, 187) (Table 2b, Appendix G). We found no narrow-headed or Mexican garter snakes during our 1993 surveys. Surveys of historical narrow-headed garter snake localities (98, 104) failed to turn up any of that species.

We surveyed five ranger districts in 1993 (Table 3c). The greatest number of surveys was conducted in Pleasant Valley Ranger District (n=23) and the fewest in Tonto Basin Ranger District (n=8). No surveys were conducted in Mesa Ranger District in 1993 (Table 3c). For a complete list of target and non-target amphibians and reptiles encountered during 1993 surveys, see Appendix G. For UTM coordinates of historical sites for target species and sites at which we found target species in 1993, refer to Appendix H.

Both Years: One hundred and seventy-four surveys were conducted at 152 sites in 1992 and 1993. Twenty-two sites (15, 19, 23, 24, 53, 63, 85, 87, 88, 98, 104, 107, 110, 115, 118, 120, 121, 128, 173, 175, 176, 204) were visited both years (Appendix E, G). Since behavior and life histories of amphibians and reptiles are highly variable, multiple visits during different times of day, seasons, or years are often necessary to detect even presence/absence of target riparian "herps" in potential or historical habitats. Visits were made both years to check: 1. high potential sites with negative 1992 survey results (19, 24, 63, 104, 107, 110, 128, 176), 2. newly discovered populations of target organisms (85, 87, 88, 204), 3. localities at or near historical

localities (98, 104, 107, 110, 176), and 4. localities in Pinto Creek drainage (115, 118, 120, 121, 128, 173, 175). During these visits, the same species of target organism were detected both years at four sites (23, 87, 88, 204), while one site (121) was found to have a different target species each year. Seven sites (15, 53, 85, 115, 118, 173, 175) were found to contain target species in 1992, but not in 1993, while three (19, 24, 63) were found to have the opposite situation.

DISCUSSION

Leopard Frogs - Statewide Pattern of Occupancy of Historical and Potential Habitats: Data collected from many parts of Arizona during the past decade indicate a severe decline in leopard frog populations (Clarkson and Rorabaugh 1989, Sredl 1993b, Sredl et al. 1994). Survey data are adequate to support this contention for three of the five native Arizona leopard frogs: the northern, Chiricahua, and lowland leopard frogs. For two of these three species, northern and Chiricahua leopard frogs, the statewide pattern of occupancy of historical localities is similar: historical localities which supported populations of leopard frogs as recently as the late 1970's to mid-1980's no longer appear to support populations of frogs.

Lowland leopard frog populations have not shown a severe, rangewide decline. This species appears to be doing well in central Arizona (Sredl and Howland 1992a), but poorly in southeast Arizona (Clarkson and Rorabaugh 1989, AGFD unpubl. data), and has apparently been extirpated from New Mexico (C.W. Painter and R.D. Jennings pers. comm.) and California (Clarkson and Rorabaugh 1989).

The status of Ramsey Canyon and plains leopard frogs is less clear. Populations of the newly described Ramsey Canyon leopard frog (Platz 1993) are restricted to a few canyons in the Huachuca Mountains. These populations appear stable (J.E. Platz pers. comm.), but their small number, size, and susceptibility to catastrophic climatic events or disease are cause for concern. Preliminary data for the plains leopard frog indicate a severe decline, but these data are incomplete.

TNF Pattern of Occupancy of Historical and Potential Habitats: In 1992 and 1993, lowland leopard frogs were found at a large number of sites in the national forest. Populations at many of these sites appear healthy. Most of the 35 sites where these frogs were found were small creeks, springs, or stock tanks adjacent to creeks. While this species has been recorded from large lotic and large lentic systems, we found few frogs in these systems. Continued surveys will undoubtedly turn up more localities at small lotic and adjacent lentic localities, and, hopefully, more populations in larger aquatic systems.

It is encouraging to note that the survey results for lowland leopard frogs from our 1992-1993 TNF surveys are similar to those of Sredl and Howland (1992a) from 1991 surveys. We agree

with their conclusion that central Arizona lowland leopard frog populations appear to be healthy. However, the conclusions from both studies must be accepted with some caution because "health" is based predominantly on the large number of extant populations encountered during surveys, and most of these extant populations are newly discovered. Because of the lack of baseline historical data, neither data set can comment on the status of TNF populations from a historical perspective. Previous workers have recorded lowland leopard frogs from only two small regions in the national forest. Platz and Frost (1984) reported this species from two sites along Sycamore Creek, one south of Punkin Center near Lake Roosevelt, and one south of Canyon Lake. Clarkson and Rorabaugh (1989) were able to locate lowland leopard frogs at three sites in the Sycamore Creek drainage. This small number of historical localities undoubtedly reflects collection bias.

If our 1992-1993 surveys found anything to cause concern, it is that many sites where we found leopard frogs to be super-abundant in initial surveys were devoid of frogs during our follow-up surveys conducted three to nine months later. This observation was not just made at isolated localities but in large regions (e.g. Pinto Valley). Much of this variation may be attributable to natural processes and can be explained by the following observations: 1. The majority of frogs observed during initial trips were metamorphs, and Sredl and Seim (1994) have shown juvenile survivorship in natural populations to be low; 2. Lowland leopard frog populations fluctuate a great deal (Sredl and Seim 1994); 3. Activity of leopard frogs varies seasonally. Absence after super-abundance may be a natural phenomenon, but it underscores the importance of multiple visits to a site during different seasons and years (Sredl and Howland 1992a) and noting approximate sizes and numbers of frogs encountered during surveys.

In Arizona, the range of the Chiricahua leopard frog is divided into two portions. One portion of the range occurs in the southeastern part of the state and the second centered along the Mogollon Rim. The Chiricahua leopard frog populations of TNF occur along the southern edge of the northern portion of this range.

While TNF lowland leopard frog populations appear to be healthy, Chiricahua leopard frog populations are not. They were not found at either of the two historical localities surveyed. We did find Chiricahua leopard frogs at three new localities, but all were close to one another, and all three sites were found to have factors (bullfrogs and green sunfish) which could severely jeopardize their future existence (see discussion below).

Causes for Amphibian Declines in Arizona and Elsewhere: Amphibian populations have declined globally (Barinaga 1990, Philips 1990, Blaustein and Wake 1990). Many factors have been implicated in the global decline of amphibian populations, including introduction of exotic organisms (in Arizona - crayfish, predatory fishes, and bullfrogs), higher levels of UV radiation due to thinning of the ozone layer, toxic substances (heavy metals, herbicides, and pesticides), increased incidence of disease due to weakening of the immune system, and destruction and fragmentation of habitat. However, many aquatic systems in Arizona where leopard frog declines

have been noted are large, heterogeneous, and still appear to have good leopard frog habitat, relatively few disturbances, and no new (post-1975) factors which would have negatively impacted leopard frog populations (M.J. Sredl, S.G. Seim pers. obs.), so in many instances the cause(s) of population declines remains unclear.

One likely cause of decline for leopard frog populations in the arid Southwest is habitat fragmentation and isolation of local populations. Because Arizona leopard frog populations are subject to boom and bust population cycles and are locally unstable (Sredl 1993a, Sredl and Seim 1994), their persistence may greatly depend on the existence of adjacent populations and connecting dispersal corridors. This "population of populations" (termed a metapopulation, Levins (1969)) consists of occupied and unoccupied habitat patches connected by corridors. An example of an apparently functioning extant metapopulation of Arizona leopard frogs may be the populations of northern leopard frogs in and near Stoneman Lake in Coconino National Forest (Sredl and Howland 1992b, Fig. 1). In a "healthy" metapopulation, within patch dynamics such as birth, death, and numbers of frogs at a site and between patch dynamics such as dispersal or existence of vacant potential patches are both important. Therefore, factors which affect within or between patch dynamics such as quality of local habitats or dispersal corridors may impact the dynamics of more than one population.

In Arizona, aquatic habitats have been greatly altered. Damming, draining, and diverting of water have fragmented formerly contiguous aquatic patches. In many areas, fragmentation has been accentuated by the introduction of exotic predatory fishes and bullfrogs (predators and competitors of leopard frogs), further reducing a frog's chances of surviving dispersal between patches (Bradford et al. 1993). Since local populations of leopard frogs are prone to extinction, it is important to maintain dispersal corridors as avenues for recolonization. Even vacant areas of potential habitat, where "new" populations may become established, are an important habitat component for normal metapopulation dynamics. While extinction and recolonization may have been a normal occurrence in leopard frog populations historically, it is possible that extinction rates are now higher and recolonization rates lower because of habitat degradation.

Causes and Solutions of TNF Declines: Differences in metapopulation dynamics may partially explain the divergent pattern of the extant populations of leopard frogs in TNF. Lowland leopard frogs show a greater preference for lotic habitats than Chiricahua leopard frogs, which are more of a pond-dwelling frog (Sredl et. al 1994). Historically, beaver ponds were numerous along the Mogollon Rim (T. Hildebrandt pers. comm.) and throughout Arizona (Davis 1986). Beaver ponds were probably an important habitat for Chiricahua leopard frogs, and would provide lentic habitat within linear lotic systems, and support numerous well-connected populations of these frogs in the Mogollon Rim country. Today, stock tanks are the most prevalent lentic habitat in this area, but tanks may not be permanent or well-connected enough to support regional populations of leopard frogs for long periods of time. Frog Pond and the adjacent stock tanks appear to serve as sources for one another, much like Stoneman Lake serves its adjacent systems.

Additional surveys may identify new populations of Chiricahua leopard frogs, but even if this happens, it is unlikely that large source populations such as Stoneman Lake will be discovered. Active management will be necessary to maintain viable populations. Moving frogs or facilitating dispersal between isolated populations may become an essential conservation strategy for Chiricahua leopard frogs in TNF.

In addition to habitat or metapopulation fragmentation, there are other important threats to TNF leopard frog populations. Crayfish are abundant in many drainages. Crayfish, introduced to Arizona, are thought to compete with tadpoles for vegetation and prey on eggs, tadpoles, and small adults. Other potential threats to TNF leopard frog populations are bullfrogs (*R. catesbeiana*) (Moyle 1973, Schwalbe and Rosen 1988, but see Hayes and Jennings 1986) and introduced fishes, especially salmonids and centrarchids (Hayes and Jennings 1986, Bradford et al. 1993). Bullfrogs, not native to Arizona, are important threats to leopard frogs, garter snakes, and other wildlife in Arizona and elsewhere. They were found at many sites visited both years. We found (and removed) bullfrogs at two of the three Chiricahua leopard frog populations. Because bullfrogs threaten the viability of leopard frog populations, they should be removed when located, especially when in close proximity to extant leopard frog populations. Removal of bullfrogs, although difficult, is possible if they are detected prior to establishment of a reproductive population.

Translocations (or relocations) of leopard frogs to suitable localities short distances from extant populations may be one strategy which could maintain demographic and genetic diversity and increase the stability or establishment of metapopulations. This strategy would facilitate natural processes such as dispersal and establishment, and, if coupled with habitat restoration, could, under semi-natural conditions, provide a necessary boost to populations that might otherwise be unable to survive. Other projects which may help the persistence of leopard frog populations include exclusion of livestock from sections of stock tanks, thus allowing growth of perimeter vegetation, and repair of stock tank berms or renovations of other aquatic systems to increase the permanence of water.

Arizona Toad and Garter Snakes: Observations of target species besides leopard frogs were too few to allow many conclusions. We have incorporated changes in our survey protocol to improve our success at observing these species during our surveys. Appropriate time is extremely important if surveys for Arizona toads are to be successful. Because of the timing of the cost-share agreement and commencement of field work, Arizona toad surveys in 1992 were conducted too late in the season to find breeding adults. In 1993, we did begin surveys early enough and did find breeding adults in Pinto Creek in April. Most of our surveys were conducted during the day, when we would be able to detect metamorph Arizona toads, but we did not find any in either year.

Surveys for target garter snakes were not productive. Most of the low success rate both years is due to the secretiveness and low densities of garter snakes when compared to the other target

organisms. Another contributing factor to low success in 1993 was the heavy rains and high flows. A short duration, visual survey is not an effective method to survey for these snakes (Campbell and Christman 1982). More intensive, longer-duration searches or trapping techniques would be more effective. However, the benefit would be outweighed by the cost to ranid frog surveys (many fewer sites surveyed). Because of the large number of non-target garter snakes observed (mostly black-necked and wandering), it is doubtful that problems with surveyors' search image was much of a factor in the low numbers of observations of target garter snakes. In the future, if it is desired to have more comprehensive survey data for the target garter snakes, surveys specifically designed for these taxa should be employed.

Recommendations: We make the following recommendations for conservation and management of TNF riparian herpetofauna. While we realize implementation of some of these recommendations will require additional funding, AGFD looks forward to continued cooperative funding for implementation of as many of these recommendations as possible.

1. Continue surveys to document current status and distribution of target species at historical and high potential sites.
2. Monitor extant herpetofauna populations, particularly for impacts from introduced organisms (crayfish, bullfrogs, and sportfish) or other factors suspected to have major effects on native herpetofauna populations.
3. Identify potential habitats for possible future management activities including:
    a) Translocate leopard frogs short distances to maintain or create metapopulations.
    b) Protect remaining aquatic habitats (those occupied and unoccupied by target species) from development, logging, heavy grazing.
    c) Restore degraded aquatic habitats, including repair of artificial habitats, vegetation, or livestock exclosures where appropriate.
4. Conduct limited numbers of surveys in areas with high potential for occurrence of target species.
5. Initiate research into potential causative factors of decline of ranid frog populations in TNF and elsewhere.
6. Add the Arizona toad to the Regional Forester's (Region 3) Sensitive Species List.

Data gathered in 1992 and 1993 have substantially increased our knowledge of all target riparian herpetofauna. Field data have elucidated the current distribution of leopard frogs better than that of the Arizona toad and the garter snakes. This report and associated references and appendices should help biologists make more informed decisions as to impacts of proposed land management actions on riparian herpetofauna.

Table 1. State, Federal, and U.S. Forest Service status designations of target riparian amphibian and reptile species [AGFD=Arizona Game and Fish Department (1988), ST=state threatened, SC=state candidate; USFWS=U.S. Fish and Wildlife Service (1991), C2=category 2; USFS=U.S. Forest Service (1988), S=sensitive].

Species	AGFD	USFWS	USFS
Chiricahua leopard frog (*R. chiricahuensis*)	ST	C2	S
northern leopard frog (*R. pipiens*)	SC		S
lowland leopard frog (*R. yavapaiensis*)	SC	C2	S
Arizona toad (*Bufo microscaphus*)		C2	
Mexican garter snake (*Thamnophis eques*)	SC	C2	S
narrow-headed garter snake (*T. rufipunctatus*)	SC	C2	S

Table 2. Number of sites surveyed for riparian herpetofauna on the Tonto National Forest in 1992 by:

a) target species history.

Sites with target species	31
Sites without target species	75
Historical localities	5
Historical localities with target species	101
Total number of sites surveyed	106

b) target species presence.

Sites with Chiricahua leopard frogs	1
Sites with northern leopard frogs	0
Sites with lowland leopard frogs	29
Sites with Arizona toads	0
Sites with narrow-headed garter snakes	1
Sites with Mexican garter snakes	0

c) ranger districts.

Cave Creek	8
Globe	31
Mesa	14
Payson	12
Pleasant Valley	10
Tonto Basin	31

Table 3. Number of sites surveyed for riparian herpetofauna on the Tonto National Forest in 1993 by:

a) target species history.

Sites with target species	13
Sites without target species	55
Historical localities	5
Non-historical localities	63
Total number of sites surveyed	68

b) target species presence.

Sites with Chiricahua leopard frogs	3
Sites with northern leopard frogs	0
Sites with lowland leopard frogs	9
Sites with Arizona toads	2
Sites with narrow-headed garter snakes	0
Sites with Mexican garter snakes	0

c) ranger districts.

Cave Creek	13
Globe	13
Mesa	0
Payson	11
Pleasant Valley	23
Tonto Basin	8

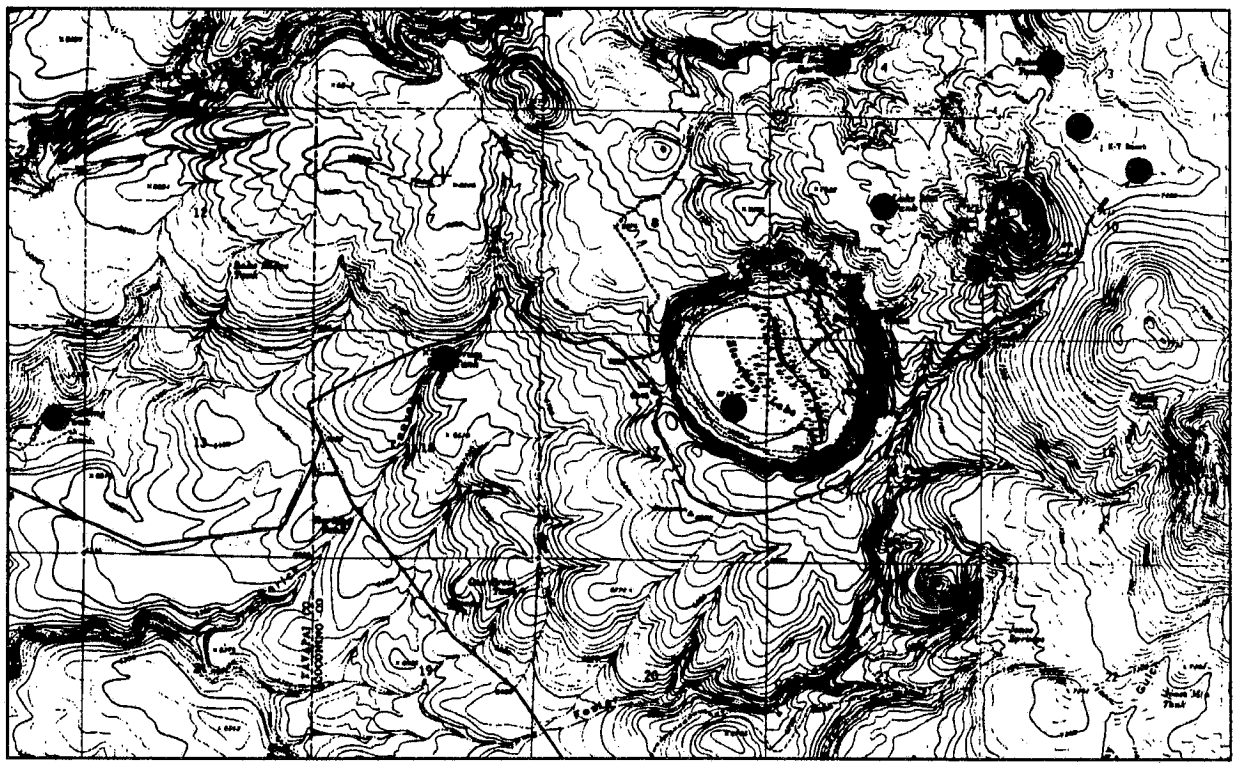

Figure 1. *Rana pipiens* sites in the Stoneman Lake area, 1991-1993.

Map 1. Sites surveyed in 1992 and 1993 for riparian herpetofauna.

Note: Because this map was in a large format, it was a separate document and was only included in one of the copies sent to the Supervisor's and District Offices.

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Appendix A. Characteristics of Arizona's Leopard Frogs

Characteristics of Arizona Leopard Frogs

Species	Above							Posterior (concealed) Thigh	Below	Male Oviduct	Misc
	Dorsal Coloration	Dorsal Spots	Dorsolateral Folds	Supralabial Stripe	Snout Spot	External Vocal Sacs	Tympanum Spot				
Rio Grande leopard frog ***Rana berlandieri***	grayish brown, brownish olive to green; even blue-green or bronze	light halo	*segmented in front of groin;* displaced medially toward rear	incomplete; wide, light-colored; fades or absent in front of eyes	usually absent	yes	usually absent	reticulation on posterior thigh bold and contrasting	dusky, especially on chest; may be mottled; groin yellow	present	*eyes large*; body robust; lower lip frequently mottled
plains leopard frog ***R. blairi***	generally pale colored; light buffy brown to dull green with brown to olive-green spots	halos narrow or absent	*usually not continuous* (segmented on lower back); displaced medially toward rear	complete; whitish stripe	usually present	yes	*well-defined*	less contrasting than *berlandieri*; reticulation more light than dark with indistinct margins	white, sometimes with fine dark mottling on throat; yellow may be present in groin;	usually absent	variable
Chiricahua leopard frog ***R. chiricahuensis***	greenish or brown; face usually green	usually lack halos; spots smaller and more numerous than in other leopard frogs	*usually broken into short segments* and displaced medially toward rear	diffuse or absent in front of eyes; incomplete	variable	yes, pea-sized	usually absent	*"salt and pepper", small white dots each with a tubercle* scattered over dark ground color	dull whitish or yellowish; yellow in groin and on lower abdomen; usually with gray mottling on throat and chest	variable	rounded head, shorter limbs and upturned eyes; skin rougher with more tubercles
northern leopard frog ***R. pipiens***	green or brownish	usually well-defined halos; *pale bordered oval or round dark spots on its back*	well-defined and are *continuous and not displaced medially* toward rear	usually complete; whitish stripe	usually present	no	nearly always absent	dark spots on lighter ground color	white to cream	usually present	-
lowland leopard frog ***R. yavapaiensis***	tan, gray-brown on light gray-green	usually lack light halos	broken into short segments and displaced medially toward rear	incomplete; usually vague	usually absent	no	faint	*reticulation* with distinct upper margin; less diffuse, less contrasting than *berlandieri*	yellow in groin, color often extends onto belly and underside of legs; tend to lack chin mottling	usually absent	tuberculate skin as in *chiricahuensis*

Ecological Information for Arizona's Leopard Frogs

Breeding seasons in Arizona:

Nearly all of Arizona's leopard frogs are opportunistic breeders to a certain degree. However, there are some trends.

Rana yavapaiensis - early spring
R. pipiens - late spring
R. blairi - early summer
R. chiricahuensis - <1800 m elevation spring, >1800 m summer

Elevation trends:

Rana yavapaiensis - 600-1800 m
R. chiricahuensis - 1000-2600 m
R. blairi - 1300-1800 m
R. pipiens - 1800-2750 m

Species sympatrically in Arizona

R. chiricahuensis - *R. yavapaiensis*
R. chiricahuensis - *R. pipiens*
R. chiricahuensis - *R. blairi*
(*R. yavapaiensis* - *R. pipiens*?)

Glossary

Above:

Dorsal Coloration: the background color of the dorsal surface

Dorsal spots: round or oval spots on the dorsal surface, sometimes surrounded by light halos

Dorsolateral folds: glandular folds that run lengthwise on the dorsal surface, between the midline of the back and the side; may be broken, displaced inward, or medially toward the thigh

Supralabial stripe: a light stripe above the lip, varies in presence, completeness, and intensity

Snout spot: a faint spot in front of the eye

Tympanum spot: a light spot on the external eardrum

Posterior thigh: the portion of the thigh usually concealed when frog is at rest; there is great variation in patterning of the posterior thigh

Below:

Male oviducts: vestigial oviducts, seen only when dissected

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Appendix B. True Frogs of Tonto National Forest

True Frogs of Tonto National Forest

Michael Sredl and Jeff Howland
Arizona Game and Fish Department

True frogs, or ranids, may be distinguished from other frogs of the area by their ability to leap great distances (often to water or cover), smooth skin, and well-developed webbing on hind limbs. They often possess paired, glandular ridges, or dorsolateral folds, running along each side of the back, may be poorly defined (Fig. 1).

1A. **Dorsolateral folds poorly defined or absent; eardrum large** (as large or larger than eye) **with conspicuous fold from eye around the eardrum**; body lacking spots with well-defined borders (Fig. 2)
. . . . . .bullfrog (*Rana catesbeiana*)

1B. **Dorsolateral folds well-developed at least on anterior and middle of body**; prominent dorsal spots with well-defined borders (Fig.3)
. . . . . 2 (leopard frog)

2A. **Dorsolateral folds well-developed and continuous**; posterior thigh with dark **spots**; dorsal spots with light, conspicuous halos
. . . . . .northern leopard frog (*R. pipiens*)

2B. Dorsolateral folds discontinuous and broken into short segments toward rear; dorsal spots usually lack halos or halos poorly defined
. . . . . 3.

3A. **Posterior thigh "salt and pepper" - small white dots each on a tubercle scattered over dark ground color**; dorsal spots small, numerous; a stockier frog with shorter limbs and blunter snout than other leopard frogs
. . . . . Chiricahua leopard frog (*R. chiricahuensis*)

3B. **Posterior thigh with reticulate pattern that has more dark than light** (contrast between dark and light areas not great); **reticulation with distinct margins**; yellow in axillary region;
. . . . . .lowland leopard frog (*R. yavapaiensis*)

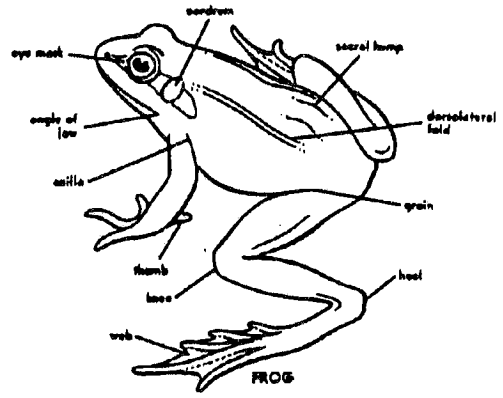

Figure 1. External anatomy of frogs and toads
(from Stebbins 1985)

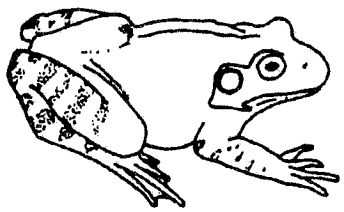

Figure 2. Bullfrog
(modified from Stebbins 1985)

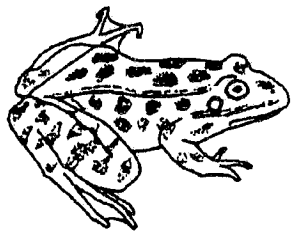

Figure 3. Leopard frog
(modified from Stebbins 1985)

Reference:
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Appendix C. Garter Snakes of Tonto National Forest

Garter Snakes of Tonto National Forest
Jeff Howland and Michael Sredl
Arizona Game and Fish Department

Garter snakes are moderately slender snakes with head slightly wider than neck (Fig. 1). Their scales are keeled, giving them a rough or dull appearance (Fig. 2). Often with three longitudinal stripes, longitudinal spots, or both. When handled, they frequently void pungent secretions from glands in their tail. In Arizona, they are often found in and around water.

1A. Stripes undeveloped or faint; **eyes placed high on head**; **head small**; olive, tan, gray-brown, or brown above with conspicuous dark spots that fade towards the tail
. . . . . narrow-headed garter snake (*Thamnophis rufipunctatus*)

1B. Stripes well-developed
. . . . . 2.

2A. Side stripes on 2nd and 3rd scale row (Fig. 3)
. . . . . 3.

2B. Side stripes on 3rd, or 3rd and 4th scale row (Fig. 3)
. . . . . 4.

3A. **Dark blotches on back of head not interrupted by middorsal stripe**; middorsal stripe brown or dull yellow and borders of stripe may not be well-defined; middorsal stripe may fade toward tail; pale ground color between stripes is checkered with dark spots
. . . . . wandering garter snake (*T. elegans*)

3B. **Two black blotches on back of head, separated by middorsal stripe**; white crescent occurs between each blotch and side of mouth; middorsal stripe orangish; top of head gray
. . . . . black-necked garter snake (*T. cyrtopsis*)

4A. **Side stripe on 3rd scale row (2nd and 3rd toward rear of body)**(Fig. 3); **pale with checkered pattern of squarish black blotches on a brownish, brown, or olive ground color**; paired black blotches at back of head; whitish or yellowish crescent occurs between each blotch and side of mouth; top of head usually olive
. . . . . checkered garter snake (*T. marcianus*)

4B. **Side stripe on 3rd and 4th scale row (2nd and 3rd toward rear of body)**(Fig. 3); paired dark brown blotches at back of head; whitish or greenish crescent occurs between each blotch and corner of mouth; yellow to cream middorsal stripe; sides olive or brown, checkered with dark spots
. . . . . Mexican garter snake (*T. eques*)

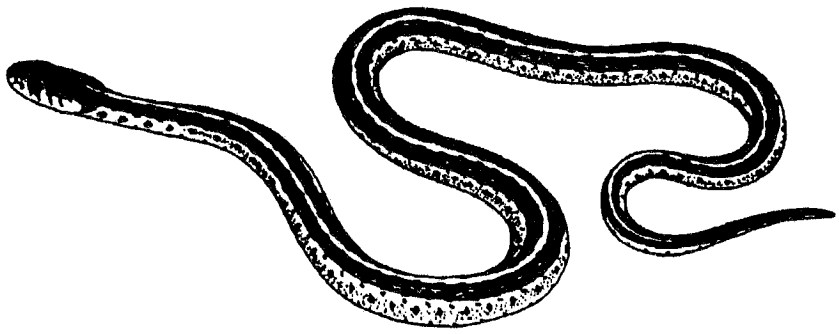

Figure 1. Garter snake (from DeGraaf 1983)

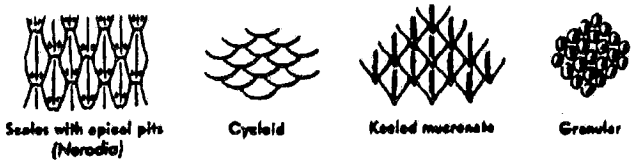

Figure 2. Scale types (from Stebbins 1985)

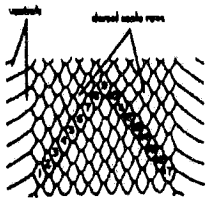

Figure 3. System of counting scales (from Stebbins 1985)

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Appendix D. Riparian Herp Survey Form

RIPARIAN HERP SURVEY FORM

Locality Data

SITE: ______________________

SITE_AT: ______________________

NUM: [| |]-[| | |]

QUAD: ______________________

MIN: [7.5 | 15] YR: [| | |]

MGT_UNIT: [| |] COUNTY: [|]-[| | |]

SUB_UNIT: ______________________

TWN_RNG [T | | . | | R | | . | |]

SEC: [|]

TRS_COMM: [| |] of [| |]

UTM_X: [| | | | |] E ZONE: [11 | 12]

UTM_Y: [| | | | | |] N

ELEV: [| | |] [M | F] H_CLASS: [0 | 1] H2O_TYPE: [1 | 2 | 3 | 4 | 5 | 6 | 7] BASIN: [| | | . | | | | | | | | |]

DIRECTIONS: ______________________

____

____

Herpetofauna Observations

SPECIES	CRT	STAGE	MESO_HAB	POSIT	COVER	NUM_OBS	COMMENTS
	0 1	E L J A	R A B I O C M F U T	L S D	T R U V D		
	0 1	E L J A	R A B I O C M F U T	L S D	T R U V D		
	0 1	E L J A	R A B I O C M F U T	L S D	T R U V D		
	0 1	E L J A	R A B I O C M F U T	L S D	T R U V D		
	0 1	E L J A	R A B I O C M F U T	L S D	T R U V D		
	0 1	E L J A	R A B I O C M F U T	L S D	T R U V D		
	0 1	E L J A	R A B I O C M F U T	L S D	T R U V D		
	0 1	E L J A	R A B I O C M F U T	L S D	T R U V D		
	0 1	E L J A	R A B I O C M F U T	L S D	T R U V D		
	0 1	E L J A	R A B I O C M F U T	L S D	T R U V D		
	0 1	E L J A	R A B I O C M F U T	L S D	T R U V D		
	0 1	E L J A	R A B I O C M F U T	L S D	T R U V D		

ADDITIONAL COMMENTS: ______________________

____

____

____

____

Conditions Data

OBSERVER(S): _____

DATE: mo day yr

START: ____ STOP: ____

EFFORT:

TP	PP	LB	RB	BB

m

COLLECT: Y N

HAB_PHOTO: ____

PHO_VOUCH: ____

NOTES: _____

T_AIR: ___.___ C

T_H2O: ___.___ C

PH: ___.___

COND: _____ µS

DO2: _____ ppm

RH: ___ %

CLARITY: 1 2 3 4 5

LENTAX_L: _____ m

LENTAX_S: _____ m

LOT_WIDE: 1 2 3 4 5 6 7

SUBSTR:

1	2	3	4	5	6

%

WIND: 0 1 2 3 4 5 6

CLOUD: 1 2 3 4 5

PPT: 0 1 2 3 4

T_STORM: 0 1 2

	%	PROMINENT SPECIES
FLOAT_VEG:		
SUB_VEG:		
EMERG_VEG:		
PERIM_VEG:		
CANOPY_VEG:		

PRED:

LEECH	CRAY	ANSOP	BELO	BEET	WWFSH	CWFSH	AMTI	BFRG	TURT	GSNK	HRON	BHWK	MAMM		

LAND_USE:

AGRIC	DEV	GRAZE	LOG	MINE	REC

OTHER_ORGS: _____

ORG_OBS: _____

1993 Riparian Herp Survey Form Instructions

FIELDS TO BE FILLED OUT FOR EVERY SURVEY

FIELDS ON THE FRONT OF THE SURVEY FORM:

SITE: A "site" is any aquatic system (or portion of an aquatic system) that is > 1 mile from any other survey locality, or if less than 1 mile apart, represents a significant change in aquatic habitat types (e.g. riverine vs. lake or cienega). Record the site name as it is marked on the quad. If the site is unnamed on the quad, refer to the corresponding land management map (e.g. Forest Service map, Surface Management Responsibility map). If the site doesn't have a name, write "unnamed" preceding the feature; similarly, if the site is not marked on the quad, write "unmarked" preceding the feature (e.g. Unnamed Tank, Unmarked Wash).

SITE_AT: Use this field as needed to enhance a site name--to verbally pin-point a site. This field is especially useful for unnamed and unmarked sites and for large/long aquatic systems. Use such features as the nearest road crossing (e.g. East Verde River at Highway 87) or stream confluence (e.g. East Verde River at Webber Creek).

NUM: A site number is a unique number that, once assigned to a site, will always be used in conjunction with that site. The site number starts with a 3-letter code that describes the land manager. These 3 letters are followed by a hyphen and then a 4-digit number (e.g. TON-0001, COC-0153). Sites will be numbered in ascending, consecutive order within each management unit.

Please use the following codes:

Arizona Game and Fish -- AGF
Bureau of Land Management -- BLM
Military -- MIL
Land Grants -- LGR
National Forests -- APA, COC, COR, KAI, PRE, TON
National Parks/Monuments -- NPS
National Wildlife Refuges -- NWR
Private Lands -- PVT
State Lands -- ARZ
Tribal Lands (note: the final "R" = Reservation):

Ak Chin -- AKR	Fort McDowell -- MCR
Fort Apache -- APR	Fort Mojave -- MOR
Cocopah -- CCR	Navajo -- NAR
Chemehuevi -- CHR	San Carlos -- SCR
Colorado River -- CRR	Salt River -- SRR
Camp Verde -- CVR	San Xavier -- SXR
Gila Bend -- GBR	Tonto-Apache -- TAR
Gila River -- GRR	Tohono O'odham -- TOR
Havasupai -- HAR	Yavapai-Prescott -- YPR
Hopi -- HOR	Fort Yuma -- YUR
Hualapai -- HUR	Zuni -- ZUR
Kaibab -- KAR	

QUAD: Record the quadrangle name as it appears on the quadrangle.

MIN: Circle "7.5" or "15" to note whether the quadrangle series is 7.5 or 15 minutes.

YR: Record the year of the quadrangle as it is printed in the lower right corner of the quad. If more than one year appears on the map, record the year of the most recent revision.

MGT_UNIT: Use the same 3-letter code for the management unit as is used in the site number (see "NUM" above).

SUB_UNIT: The sub-unit further defines the land manager. Record the full name of the subunit as follows:

Arizona Game and Fish Department -- region (1-6)
Bureau of Land Management -- district (Phoenix, Safford, or Strip)
National Forest lands -- ranger district (e.g. Beaver Creek, Heber, or Pleasant Valley)
National Park/Monument lands -- park or monument name
National Wildlife Refuges -- refuge name
Private and/or State lands -- nearest city or town
Tribal lands -- nearest tribal community

COUNTY: County is always recorded as the state abbreviation (AZ) followed by a hyphen and then the first 4 letters of the county (e.g. AZ-MARI, AZ-YAVA). The county name can be found in the upper right corner of the quadrangle if the quad covers an area within a single county. For quads that cover areas in two or more counties, the names of the counties will appear somewhere in the topographic region of the quad. National Forest maps and the Arizona Highway road map are also useful in identifying counties.

Please use the following abbreviations:
APAC, COCH, COCO, GILA, GRAH, GREE, LAPA, MARI, MOHA, NAVA, PIMA, PINA, SANT, YAVA, YUMA

ELEV: Record the elevation of the starting point of the survey. Read the elevation off of the survey quad. Be sure to indicate whether the elevation is in meters (m) or feet (ft) by circling the appropriate box. The contour interval and unit (meters or feet) is written in the center of the bottom margin of the quadrangle.

H_CLASS: Circle the category that best describes the hydrological class of the water body you have surveyed:

0 -- lentic (still water)
1 -- lotic (flowing water)

H2O_TYPE: Circle one category (1-7) that best describes the type of water you have surveyed. Water type categories are based upon lotic/lentic characteristics as well as the size/magnitude of the water body:

1 -- canal (concrete diversion of riverine water)
2 -- plant outflow (sewage and electric plants; any chemical or mechanical processing of water; storm drainages)
3 -- riverine (natural flow, from raging rivers to streams to seeps)
4 -- wetland (an inland body of water that is primarily emergent vegetation)
5 -- stock tank (an earthen-dammed or dredged basin that catches run-off for livestock or wildlife)
6 -- lake (an inland body of water that is primarily open water)
7 -- reservoir (a dammed riverine system that is primarily used for recreation and/or human water supply)

TWN_RNG: Write the township and range within which the starting point of the survey occurs. Write the township as: T##.#direction (e.g. T17.0N, T02.5S). Similarly, write the range as: R##.# direction (e.g. R01.0W, R31.5E).

SEC: Write the section within which the starting point of the survey occurs. Write the section as 2 digits (e.g. 02).

TRS_COMM: Write the quarter-quarter and the quarter-section within which the starting point of the survey occurs. Write the comment as one of the 8 cardinal directions followed by 4, 2 or CTR (center). For example: NW4 of NE4 = the northwest quarter of the northeast quarter; S2 of NW4 = the south half of the northwest quarter; CTR of S4 = the center of the south quarter. Be specific: use NW, NE, SW, SE over N, S, E, W, CTR whenever possible.

BASIN: Record the basin number of the survey area as a 8-digit number as it occurs on the 1974 Hydrologic Unit Map of the State of Arizona. The map is overlaid with a grid that corresponds to Townships and Ranges. The grid will help you to pinpoint the survey site.

DIRECTIONS: Write the directions to the site. Keep the them short and pertinent (e.g. ~4.3 miles north on FS 105 from its intersection with FS 393). Directions are especially important when there are no roads or when existing roads are not marked on your maps. Use the 8 cardinal directions (N, NE, E, SE, S, SW, W, and NW) instead of "turn right" or "veer left."

SPECIES:
CRT:
STAGE:
MESO_HAB:

COVER:
NUM_OBS:
COMMENTS:
ADDITIONAL COMMENTS:

Fill out these fields for <u>any</u> riparian POSIT: herpetofauna seen. See pages 8-10 of this instruction sheet for descriptions of these fields.

FIELDS ON THE BACK OF THE SURVEY FORM:

OBSERVERS: List the names of all people present during the survey. Record the names as: first initial, second initial, and full last name (e.g. M.J. Sredl).

DATE: Record the date of the survey as six numbers giving the month first, followed by the day then the year (e.g. 10-27-93, 06-02-93).

START: Record the time the surveyor begins searching for herps; use a 24-hour clock.

STOP: Record the time the surveyor stops searching for herps; use a 24-hour clock. Include only the time spent actually searching for herps.

EFFORT: There are 5 categories of effort:

TP -- Total Perimeter
PP -- Partial Perimeter
LB -- Left Bank
RB -- Right Bank
BB -- Both Banks

Circle the categories that apply. For all categories other than TP, record the distance surveyed in meters. The minimum acceptable survey distance for linear systems and large lentic systems (>20 acres) is 400m (0.25 mile). Use category BB for any lotic system in which it is possible for you to access both banks--to meander from shore to shore. Use categories LB and RB for large, deep, and/or swiftly flowing lotic systems in which you are unable to meander shore to

shore. LB and RB should always be filled out together (e.g. LB=0200m, RB=0050m; RB=0350m, LB=0000m). Left and right banks are in reference to upstream. During the course of any survey, the surveyor should dipnet, comb through bushes and grasses, turn over rocks, and scan the water and shore for herpetofauna (see "Arizona Game and Fish Department Riparian Herpetofauna Survey Protocol").

To calculate meters walked, use a map wheel to determine the distance in miles. Be sure to use the scale on the map wheel that corresponds to the scale of your map or quad. Multiply the value generated from the map wheel by 5,280 feet/mile. Multiply this new value by 0.3048 meters/foot. Round this final result to the nearest 25-meter value.

Example: 0.5 miles X 5,280 feet/mile = 2,640 feet
2,640 feet X 0.3048 meters/foot = 804.67
804.67 ≈ 800 meters.

COLLECT: Circle "y" (yes) or "n" (no) as an indication of whether voucher specimens were collected at a site. If "y" is circled, the collection tag number(s) along with additional relevant data should be written in "COMMENTS" in the "Herpetofauna Observations" section of the survey form.

HAB_PHOTO: Note how many habitat photographs were taken at a site. Write the number as 2 digits (e.g. 00, 02). Habitat photos should be taken at any site in which target riparian herps were found, at any historical locality regardless of results, and at any survey site that has suitable habitat even though no target riparian herps were found.

PHO_VOUCH: Note how many photo vouchers were taken at a site. Write the number as 2 digits (e.g. 00, 13). Photo vouchers should be close-ups (macro shots) of diagnostic characters (i.e., thigh pattern and dorsolateral folds of leopard frogs, scale row of lateral stripes in garter snakes, dorsal and cranial views of Arizona toads).

NOTES: Use this field to describe the most outstanding features of a survey site. Don't be redundant with fields already completed. Write short, specific comments that emphasize habitat quality and why you think you did or did not find herps. Be sure to comment on any land use in, around, or near the survey area that may potentially impact the study site (e.g. large mining operation 0.5 mile upstream of survey site, agricultural spraying 1 mile from survey site). You can also use this field to describe noteworthy similarities or dissimilarities between the area searched and the total area (e.g. wash devoid of vegetation except in area of survey, survey covered the north end of the lake which was the only area with emergent vegetation).

FIELDS AT THE BOTTOM OF THE BACK PAGE:

OTHER_ORGS: This field is to be used for observations of species other than riparian herpetofauna (riparian herps are to be recorded in the "Herpetofauna Observations" table on the front of the survey form). Use "OTHER_ORGS" to list all non-riparian herps (by 4-letter genus/species code [see "Herpetofauna List -Derived from Stebbins (1985)"]), federal or state sensitive species of other organismal groups (by common name), or any other species whose occurrence merits noting (also by common name). No verbiage other than the species name(s) should be listed (e.g. UROR, SCOC, great horned owl, elk). Use the "ORG_OBS" field as needed to expand upon why you listed a species.

ORG_OBS: This is an optional field. Use this field to record noteworthy observations about any or all of the species listed in "OTHER_ORGS" (e.g. UROR observed mating, great horned owl roost site observed, area heavily impacted by elk grazing).

FIELDS TO BE FILLED OUT FOR ALL HISTORICAL SITES

AND ALL SITES WITH TARGET RIPARIAN HERPS

FIELDS ON THE FRONT OF THE SURVEY FORM:

UTM_X: This field is to be filled out in the office. Record the starting point of the survey as a 6-digit number followed by the letter "E" (E indicates that the number is an easting value). An example of a UTM x-coordinate is 295,440E. The first 3 numbers will be found on the top or bottom edge of the quad. These numbers are in 100,000-meter increments. The fourth number describes a point with ± 100-meters. The fifth number describes a point with ± 10-meters. The last number will be a zero. Use a coordinate scale to determine the fourth and fifth numbers.

UTM_Y: This field is to be filled out in the office. Record the starting point of the survey as a 7-digit number followed by the letter "N" (N indicates that the number is a northing value). An example of a UTM y-coordinate is 4,318,410N. The first 4 numbers will be found along the left or right edge of the quad. These numbers are in 1,000,000-meter increments that tell you how far north of the equator you are. The fifth number describes a point with ± 100-meters. The sixth number describes a point with ± 10-meters. The last number will be a zero. Use a coordinate scale to determine the fifth and sixth numbers.

ZONE: Circle "11" or "12" to note whether the starting point of the survey is in UTM grid zone 11 (west of 114 degrees longitude) or 12 (east of 114 degrees longitude).

SPECIES: Record all riparian herp species (target or non-target) detected during a survey in this column. Use their unique 4-letter Genus-species code (see "Herpetofauna List - Derived from Stebbins (1985)"). When an organism cannot be identified to species (e.g. "I saw a ranid-like frog," or "I saw an anuran egg mass"), use the 4-letter code that corresponds to the taxonomic classification for which you <u>are confident</u> in your identification. For the examples above, the ranid-like frog would be assigned the code "RANA," and the egg mass would get the code "ANUR."

CRT: Circle a code (0 or 1) to indicate your level of certainty about each species identification:

0 -- no uncertainty
1 -- some uncertainty

Certainty of identification should be based on species-specific diagnostic characters (i.e., thigh pattern and dorsolateral folds in leopard frogs, scale row of lateral stripes in garter snakes, lack of dorsal stripe and cranial crests in Arizona toads). For information on diagnostic characters of species, see Stebbins (1985), "Characteristics of Arizona Leopard Frogs," and "Garter Snakes of Coconino National Forest."

STAGE: Circle a code (E, L, J or A) to indicate the life stage(s) of each species seen:

E -- eggs
L -- larvae
J -- juvenile
A -- adult and subadult

MESO_HAB: Circle the code that best indicates the micro-habitat in which each species/life stage was seen:

Lotic Habitats:
R -- Riffle
A -- Active Channel Pool
B -- Backwater Pool

Lentic Habitats:	I -- Inlet O -- Outflow C -- Cove M -- Main Body F -- Flat (without water: mud flats, sand banks, marshy flats)
Terrestrial Habitats: (areas >1.5 meters from the waters' edge)	T -- Terrestrial Riparian Zone U -- Upland (non-riparian vegetation)

POSIT: For lotic and lentic systems only (not for terrestrial habitats), circle the code that best describes where you saw a species/life stage relative to the aquatic shoreline:

L -- Shoreline (terrestrial area ≤1.5 meters from the waters' edge; include animals seen half-in/half-out of water)

S -- Shallows (from the shoreline out to the "point" of drop-off, or ≤0.5 meter deep; include animals that have all 4 feet in water)

D -- Deep Water (beyond the "point" of drop-off, or in water ≥0.5 meter deep)

COVER: For all habitats (lotic, lentic, and terrestrial), select the one code that best describes the area immediately surrounding individuals of each species/life stage found:

T -- Trees/Shrubs (do not confuse with canopy cover; only use this code if an individual is found just under, on, or against a tree or shrub)
R -- Rock/Outcrops
V -- Vegetated
U -- Unvegetated
D -- Debris (including dead and down woody debris)

NUM_OBS: Enter the number of individuals (by species and life stage) encountered in each meso-habitat, position and cover type. Do not estimate total numbers within the survey area--record only the number that you saw.

COMMENTS: Use this field to elaborate upon species observations. Types of observations to include are: what criteria were used to identify a species; if species identification is uncertain, what was observed (both physical features and behaviors would be of use); record the collection number of any voucher specimens taken; note the presence of disease. Use the space available in "ADDITIONAL COMMENTS" as needed.

ADDITIONAL COMMENTS: Use this field only if you require more space to elaborate upon species descriptions/observations (see "COMMENTS" above). Be sure to reference information in this field to the species observation to which it relates by using numbers or letters (like a footnote).

FIELDS ON THE BACK OF THE SURVEY FORM:

T_AIR: Take air temperature (degrees Celsius) 1.5 meters above ground and 1.5 meters from the water. Be sure to shade the thermometer.

T_H2O: Take water temperature (degrees Celsius) 1 centimeter below waters' surface and 1 meter from shore. For bodies of water less than 2 meters wide, take temperature from the center. Be sure to shade the thermometer.

PH: Use a pH meter to measure. The water sample should be taken 1 centimeter below waters' surface and 1 meter from shore. For bodies of water less than 2 meters wide, take the sample from the center. Be sure to: 1) take the black cap off the meter before using, 2) keep the level of the water sample below the mark on the meter, 3) turn the meter on before measuring the pH of the sample, and 4) turn the meter off when finished sampling.

COND: Use a dissolved solids meter to measure. The water sample should be taken 1 centimeter below waters' surface and 1 meter from shore. For bodies of water less than 2 meters wide, take the sample from the center. Multiply LCD reading by ten and record value as S (micro-Seimens). Be sure to: 1) take the black cap off the meter before using, 2) keep the level of the water sample below the mark on the meter, 3) turn the meter on before measuring the conductivity of the sample, and 4) turn the meter off when finished sampling.

DO2: Use a dissolved oxygen test kit to measure. The water sample should be taken 1 centimeter below waters' surface and 1 meter from shore. For bodies of water less than 2 meters wide, take the sample from the center. Record as ppm (parts-per-million). Be sure to: 1) plug in probe, 2) turn meter to the O_2 setting, 3) let the meter stabilize in the atmosphere before testing the water sample, 4) let the meter stabilize in the sample before recording the value of the water sample, and 5) turn the meter off when finished sampling.

RH: Measure with a psychrometer 1.5 meters above ground and 1.5 meters from water. Record as percent. Be sure to continue to spin the psychrometer until the wet bulb has stabilized.

CLARITY: Circle one value (1-5) that best describes the survey area:

1 -- extremely clear
2 -- somewhat clear
3 -- moderately turbid
4 -- somewhat heavy turbidity
5 -- extremely heavy turbidity

LENTAX_L: For lentic systems, record the longest axis of the system in meters. Measure the entire system (not just the portion surveyed), and use the standing water at the time of the survey as your boundaries (do not use the normal waterline or highwater mark). For larger systems, estimate the length of the long axis using a map (don't rely on a visual guesstimate).

LENTAX_S: For lentic systems, record the shortest axis of the system in meters. This short axis should be the mean perpendicular axis to "LENTAX_L." As with "LENTAX_L," the short axis should reference the entire lentic system, not just the portion surveyed, and should be determined based upon the standing water present at the time of the survey, not the usual waterline or highwater mark. Use a map as a guide for larger systems.

LOT_WIDE: For lotic systems, select one value (1-7) that best describes the width of water at the time of the survey (not at the normal waterline or at the highwater mark):

1 -- 0-2 meters
2 -- >2-5 meters

3 -- >5-10 meters
4 -- >10-20 meters
5 -- >20-50 meters
6 -- >50-100 meters
7 -- >100 meters

SUBSTR: Circle from one to three categories (1-6) as appropriate. All substrate types may be present, but choose only those that best describe the actual area surveyed. In the box below each category circled, record the percent occurrence of that substrate. Percents should total 100.

1 -- mud and silt	(0.001-0.1 mm)
2 -- sand	(0.1-2 mm)
3 -- gravel	(2-32 mm)
4 -- cobble	(32-256 mm)
5 -- boulder	(>256 mm)
6 -- bedrock	(exposed sheet of rock)

WIND: Use a wind meter to measure wind speed, then check one category (0-6) as appropriate. Wind should be measured 1.5 meters above the ground and 1.5 meters from the water. Be sure to: 1) hold meter near the top so that you are not blocking any holes, 2) face into the direction of the wind while reading the meter, and 3) use the left scale for wind strengths <10 mph, and use the right scale (by putting your index finger over the red knob on top of the meter) for wind strengths ≥10 mph. Wind categories are those used in the Beaufort scale:

0 -- ≤1 mph, smoke rises vertically
1 -- 1-3 mph, wind direction shown by smoke drift
2 -- 4-7 mph, wind felt on face, leaves rustle
3 -- 8-12 mph, leaves and small twigs in constant motion, wind extends light flag
4 -- 13-18 mph, raises dust and loose paper, small branches are moved
5 -- 19-24 mph, small trees in leaf begin to sway, crested wavelets form on inland waters
6 -- >24 mph, greater effect than above

CLOUD: Circle one category (1-5) as appropriate. Cloud cover categories are based upon percent cover:

1 -- 0 - 20% cover
2 -- 21 - 40% cover
3 -- 41 - 60% cover
4 -- 61 - 80% cover
5 -- 81 - 100% cover (includes fog)

PPT: Circle one category (0-4) as appropriate. Precipitation categories are based upon the type and degree of precipitation:

0 -- no precipitation
1 -- intermittent rain
2 -- steady light rain
3 -- steady heavy rain
4 -- snow/sleet

T_STORM: Circle one category (0-2) as appropriate. Thunder storm categories are based upon the presence and proximity of thunder and lightening:

0 -- no thunder or lightning

1 -- thunder and lightning present at a distance (> 10 seconds between lightning and thunder)
2 -- thunder and lightning present nearby (≤ 10 seconds between lightning and thunder)

FLOAT_VEG: Record the percent of the area actually surveyed that is covered by **floating** vegetation. Write down the genus or common name of 1-4 of the most prominent species-- those species which best describe the surveyed area.

SUB_VEG: Record the percent of the area actually surveyed that is covered by submerged vegetation. Write down the genus or common name of 1-4 of the most prominent species-- those species which best describe the surveyed area.

EMERG_VEG: Record the percent of the area actually surveyed that is covered by emergent vegetation. Write down the genus or common name of 1-4 of the most prominent species-- those species which best describe the surveyed area.

PERIM_VEG: Record the percent of the area actually surveyed that is covered by perimeter vegetation. Write down the genus or common name of 1-4 of the most prominent species-- those species which best describe the surveyed area.

CANOPY_VEG: Record the percent of the area actually surveyed that is covered by canopy vegetation. Write down the genus or common name of 1-4 of the most prominent species-- those species which best describe the surveyed area.

PRED: Circle all appropriate boxes so as to indicate the type of predators seen or otherwise detected (e.g. by sign) at a survey site. In the boxes below the predator types, insert a code (1-3) so as to suggest the magnitude of each predators' abundance:

1 -- present/detected
2 -- moderate numbers present
3 -- abundantly present

Most of the predator categories lump together similar organisms and/or organisms with similar effects on riparian herps:

LEECH --	**leeches**
CRAY --	**crayfish** (include claws and carapaces as evidence of presence)
ANSOP --	**dragonflies**, adults and larvae
BELO --	**belostomatids**
BEET --	large aquatic **beetles**: hydrophillids and dytiscids
WWFSH --	**warm water fish**: bass, carp, catfish, perch, sunfish, walleye
CWFSH --	**cold water fish**: trout
AMTI --	**tiger salamander** (also write-up in the Herpetofauna Observations table on the front of the survey form)
BFRG --	**bullfrogs** (also write-up in the Herpetofauna Observations table on the front of the survey form)
TURT --	**mud turtles** (also write-up in the Herpetofauna Observations table on the front of the survey form)
GSNK --	**garter snakes** (also write-up in the Herpetofauna Observations table on the front of the survey form)

continued on next page

HRON -- **large wading birds**: American bittern, black-crowned night heron, egrets, great blue heron, night heron

BHWK -- common **black-hawk** and zone-tailed hawk

MAMM -- medium-sized **mammals**: skunk, ring-tail, raccoon (include footprints and scat as evidence of presence)

____ -- blank to **fill in** another predator group

LAND_USE: Circle all appropriate boxes so as to best indicate the type of land use at a survey site. For noteworthy land uses that are not immediately at the survey site but which may impact the study site (e.g. large agricultural fields within 1 mile of survey site, active mining operation 0.5 mile upstream of survey area), fill out the land use field as described here, and also make written comments about the land use in the "NOTES" field. In the boxes below the land-use types, insert a code (1-3) so as to suggest the magnitude of each land-use occurrence:

1 -- use detected
2 -- moderate usage
3 -- heavy usage

The land-use categories are:

AGRIC -- **agriculture** (include agriculture fields, diversion canals, etc.)

DEV -- **human development** (include road construction, dam site, housing development, etc)

GRAZE -- cattle **grazing** (include manure, hoofprints, increaser species, and grass length as evidence of grazing use); note elk/deer grazing in "OTHER_ORGS" and"ORG_OBS," but only if heavy

LOG -- **logging**

MINE -- **mining** (include 50+ year tailings/shafts, currently active mines, small claims, and large developments)

REC -- **recreation** (include campsites (developed and primitive), trails, litter, etc.)

Appendices E through H are intentionally ommitted from this document because they contain sensitive locality information. If you need the information in the appendices, please write to us at the following address:

Nongame Branch
Arizona Game and Fish Department
2221 W. Greenway Rd.
Phoenix, AZ 85023